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ABSTRACT

This paper describes a University of Girona (Spain) project in which an interdisciplinary group has created an integrated platform for teachers to use to create and publish dynamic and interactive teaching materials that make use of new information technologies. Project objectives are summarized and an overview is provided of the functions of the two main modules of the platform: the Units Creation Module (UCM), which supports the creation of the didactic units by teachers, and the Units Navigation Module (UNM), the tool used to access the materials which are created using the UCM module. The following features of the UNM are then described in detail: the login procedure; user categories (supervisors, teachers, students, and guests); design of the main screen; and the function of each button, including navigation, help, information (bibliography, questions), tools (map of contents, note book, print, progress information), and communications (synchronous communication, teacher's mail, news). Two figures illustrate the main navigator screen, and the first main navigator screen. (DLS)

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Support Units for University Teaching based on WWW[1]

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Abstract : We are living a new "Information Age". The massive use of the new information and communications technologies is producing important changes in our society, with respect to the way we live, work and communicate. The paradigm of it is the already omnipresent Internet.

One of the university's teaching objectives is to form the professionals for the future. The students, we have today in our classrooms will meet tomorrow the necessity of knowing and using these new instruments when they attain the labour market. At the same time, if used properly, these tools can help to innovate and improve the university teaching and learning process.

At the University of Girona, an interdisciplinary group has started the project to create an integrated platform where teachers can create and publish new dynamic and interactive teaching materials that make profound use of all the new possibilities offered by the information technologies. The platform will also be used by the students to access these materials in a decentralised way from anywhere on the Internet, and at the same time by the teachers to keep track of students' utilisation. It also improves and facilitates communications between students and teachers, at all levels.

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1. Introduction

Among all the services that Internet can offer, the World Wide Web [W3C] (WWW or simply "web") provides an excellent platform for publishing and disseminating a wide variety of curriculum materials. These can go from textual resources that resemble traditional linear class notes, to highly dynamic and interactive non-linear materials, including multimedia resources (text, images, sound, video, animation sequences and interactive simulation applications). All these web-based materials can be available world-wide from the Internet.

The capacity of presenting multimedia information has made the web an effective tool for education. The interactive nature of this medium can enhance the teaching and learning process. It can be a fantastic tool for a constructive approach of this process, in which the educator and the learner are active agents in their respective progress. Moreover, it can be used as a mean to understand complex systems and ideas.

Internet based communications services such as electronic mail, news, Internet Relay Chat or videoconferencing tools, allow the collaboration between students and teachers. A student can communicate with its teachers and peers without the relative constraints of having to meet at specific places and times. Students can work on learning materials at own pace and discuss them with other people when they have questions, sharing experiences with others. They can learn individually but not alone; they can be physically separated but study together through computer networks.

2. The Project : the Teaching Support System

Based on the above argumentation an integrated platform is proposed. Basically, the objectives of the project are:

- Make possible for any teacher to create dynamic and interactive multimedia teaching materials, using the new standard information presentation techniques. These materials can be created from predefined templates by using imported resources made with any standard text, graphics, sound or video tool, or using specific tools such as web creators. The tools that enable this objective must be designed to be used by teachers without any previous computing knowledge.
- Enable teachers, students and authorised persons to access all resources in a decentralised manner, speaking both in terms of space and time, and with the benefits of the hypertext concept. Since all the materials are created around HTML and put on the web, they can be easily accessed from the web using any standard browser like Netscape or Internet Explorer, from anywhere and at any time. The information is structured in a non-lineal basis, and therefore each student is able to access it according to his own learning patterns, needs

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and initiative. Moreover, the use of associated technologies will make several types of multimedia and interactive units possible.

- Improve and facilitate communications and collaboration between students and teachers at all levels. The Internet gives services that facilitate the communication. The platform will make full use of these communication services in an integrated way with the materials.
- Provide an well-dimensioned environment to students in order to access the huge amount of resources available on the Internet, besides own local cites and incentive them to be active members of the net in all aspects, but also instructing them to make a wise and effective use of it.
- Give the training and advise university teachers will need in order to be able to construct didactic units for their courses, not only using the tool but making wise and effective use of courses and the Internet. Also, the collaboration between them for creating better materials is encouraged.
- This project doesn't intend to substitute the traditional teaching in the class room, but to complement it.

In order to achieve these objectives, our platform need two different main modules. One of them is used by teachers to make the units, and the other one to make it possible for the students (and other people) to use these units. We will call them Units Creation Module (UCM) and Units Navigation Module (UNM) respectively.

The main function of the UCM module is the creation of the didactic units by teachers. But it is important to highlight that we are not only speaking of computer science teachers but all teachers. Therefore, the UCM must be easy to use and it must not require any programming skills nor a lot of new tools to learn. To achieve the last goal, the UCM will be able to make use of materials created using most common standard programs, like word processors, graphics packages, etc. Importing them into predefined templates, the UCM will generate the materials ready to publish. A lot of templates will be provided to adapt to many types of materials.

The complete implementation of the UCM module will be in a further phase of the project. On the first phase, a first version of the UNM module is designed and implemented. We use already existing standard tools (under a set of basic guidelines) to make the first test units to evaluate and tune the UNM. The current performance of these standard tools have partially covered the initial objectives for the ACM module.

The UNM module is the tool used to access the materials which are created by using the UCM module. Being the units created using HTML, it could seem that using an standard HTTP client and server would be sufficient, but our project goes beyond what is achievable using the standard browser controls and common HTTP server features.

The functions of the UNM module and its utilisation are shown in the following section, the variations of the initial proposal [INET96] are also presented.

3. Navigator module description

The materials offered to the users will be structured around "units". A unit would be a lesson about some topic.

To access the units, the user needs a standard WWW browser supporting JavaScript and Java. After connecting to the starting URL [WAO], the user get a login dialogue, where the user have to identify himself by entering a login and a password. Without completing this process, the user will not be authorised to use the materials.

This login procedure shown above has two major purposes:

1. Be able to identify single users in order to keep track of them when using the units, and customise it for each of them if needed. Also, prevent unauthorised users to access the materials.
2. Be able to distinguish users categories with different privileges. The units can behave differently according to the privileges of the user. Some user categories may have access to features others will not.

Related to the above points, there are four user categories: Supervisor, Teachers, Students and Guests. The Supervisor acts as the system manager and, therefore, has total control over the UNM. He is responsible for assigning a login and password to the users, install units and keep the system running correctly. Teachers have full access to all the materials, including control and supervision features. Students will be able to fully navigate the units contents and make use of all features that the teachers prepared for them, but not the control or supervision functions. Finally, guests will have limited access to some of the units contents according to the teachers' criteria. A login and password is assigned to teachers and students by the system manager, while guest users will only have to enter "guest" as login name.

It is interesting to record, the whole process that all users carried out. All sessions corresponding to an user are added to a log-file. The units which this user has visited in this session are booked. Therefore, at the beginning of each session the user can examine its previous work.

Figure 1 shows the aspect of the main screen that the users will face after login to the system and selecting one of the available units. Note that it is only a suggestion, and the final aspect may differ or even be user-customisable, but we will use it to describe all the functions.

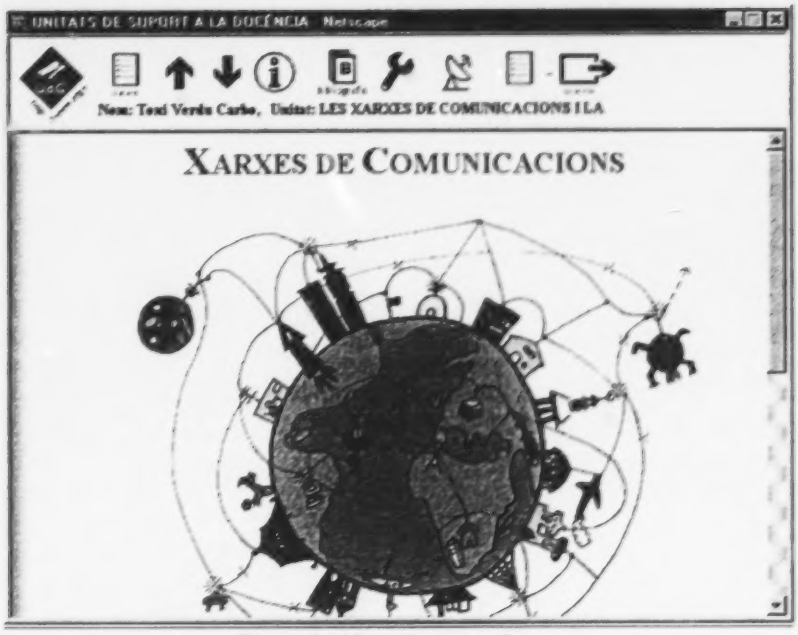

Figure 1 : Main Navigator Screen

This screen has two main elements: the header and the body. In the header, is the information about the unit used (course, author, name of the page, etc...) and the buttons. These buttons give additional features to complement the basic unit contents shown in the body window, and to enhance the navigation process. The body window is where the basic contents of the unit is displayed. All the menus and toolbars from the standard browser could be disabled, so all the navigation functionality is done by using these buttons.

Initially, the body was designed as a central window rounded by several buttons. The functionality of the buttons was focused on the navigation and the interactivity between users and teacher. Each button will add a different complementary function to the basic unit contents. The buttons on the left are associated to general functions (for all content pages and even for all the units), and the ones on the right are for specific functions (the author can decide if they are active or not, depending on the content page or unit being used. Note that some of the buttons may behave differently (or even be inactive) for some user types.

During the implementation of the test bed, to experiment with the first didactic unit, the navigation module was tuned. Training with eleven users in the class room, the drawbacks of this first scheme were detected and corrected. Moreover, new features and a new distribution of the buttons were proposed. This modification process is also presented in the following section.

The major modifications have been carried out on the main presentation screen for navigating. The necessity to include more text and graphic information leads to augment the visualisation area. Therefore, from a buttons-rounded central area we changed to a single header, to identify the user, the unit and the essential buttons to active the remainder functionality.

Each button is briefly described hereafter:

(Button "Navigation") First, we have the navigation buttons. Besides the common "back" and "forward" features found with all browsers, we have "previous", "next" and "up" buttons that will make possible to navigate the unit following a hierarchical order predefined by the creator of the unit.

(Button "Information") It will give information related to how the tool works, how the buttons work, etc. This is the always useful poping-up HELP window we can find in most applications. It will also include guidelines and advice to make a good use of the tool.

(Button "More information") In this case, new knowledge about the current lesson can be achieved by the user. This is the extension and consolidation of the knowledge about the unit which the user is into.

(Button "Bibliography") It shows the bibliography of the unit and links to related documents on the web. Although bibliography could have been integrated with the whole unit, we have considered that it would be useful to have it easily accessible. When a student clicks the button he will get a new window with the recommended bibliography (including books and Internet resources as well). But teachers will have additional functionality to modify the bibliography on-

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line, in a similar way as the FAQ function.

(Button "Questions") This button presents the student with complementary questions to help him know if he has learned the basic concepts explained in the unit, and make a self-evaluation. It also will give access to a set of complementary activities proposed by the teacher, like tests, exercises, concept associations, etc. The student will get automatic feedback. So he will be able to know automatically if the answers he gives are correct or not. Teachers will be able to consult students' answers over time, and get various reports like "the most incorrectly answered question" and the likes.

These activities are created using the UCM, and consist of a set of predefined activities. For instance, to create a test teachers will be asked for a set of information like the title of the test, the number of questions, the number of options for each question, the text of the questions and the options, the score, etc. From that input, the UCM module will generate all the necessary items in order to put the test on the server and make it work and available to the students. The same procedure will be used for all other activities available.

(Button "Tools") A set of tools are accessible to the user through this module. Utilities to seek information into the unit are provided. This information can be used by the user in the future.

(Button "Map of Contents") This button shows the user a complete tree of the unit being used, showing all pages and how they are linked. This tree will be based on the directory tree function we can find in Windows 95 Explorer, with similar capabilities. It will be possible to "fast jump" to any page of the unit by clicking on it on the tree. Moreover, this tree will inform the user about which pages have already been visited by him (and how many times, how much time he has spent there, etc.), and which ones not. It also will help the students to make a better idea of the layout of the unit and to easily locate important pages or nodes. This is a useful feature because hyperlinked documents are not lineal and therefore it is very easy to get "lost in cyberspace", or forget to visit a whole set of pages only because some link has not been followed. The teachers will be able to look not only at their own tree but at the particular tree of each student, and then warn them about any contents they may be missed.

Using that tree function it will be possible for the user to see and modify the printing order of the unit, or select a subset of pages to print.

(Button "Note book") This opens an external text editor where users will be able to take notes about the unit they are using. The objective is to give the "piece of paper and pencil" to the users who surely will need to take notes according as they study the unit. It is basically an external editor, and as with the dictionaries above, it can be either a local one or a Java applet downloaded from the server.

(Button "Print") This one is meant to solve one of the most important inconveniences people using the web are facing: how to print a whole site, or a set of pages. Browser's printing capabilities make possible to print only one page at a time (the page that is being viewed). So if anyone wants to print a set of pages he must go and download one after another and print them separately. Trying to print a whole hypertext document can be a nightmare. With the printing tool we are able to print all the pages of a unit, following a predefined order stated by the unit creator. Moreover, with the use of the "tree" function it is possible to print only a set of pages, or even change the printing order.

(Button "Progress information") Teachers will have another button that will give them access to the reports window. From there, teachers will be able to ask for a set of reports about student activity. For instance, they will be able to know all the information about any student activity, know which pages are the most and less visited, to know which question in the test is the most incorrectly answered, etc. Also, students could optionally have access to this button to get reports about their own progress.

(Button "Communications") The communication among users and between the unit's authors and users is allowed.

(Button "Synchronous communication"). This function requires communication parts to be on-line at the same time. When a user clicks this button, he is transported to an space where he is able to meet other people using the unit at the same moment, so being able to start a text-based conversation, debate, etc... It's meant to be a sort of IRC, complemented with shared blackboard, but again very simplified and with much more control by the teacher. In the future, it will be enhanced to support not only textual communication, but audio and video, thus becoming a videoconferencing tool. Using this function we can get benefits equivalent to the study in group, but without the need of people being in the same place. Virtual classrooms can be also possible.

When clicking this button, a new window will open and will put the user in the "General" conversation area. Here he will find other people and start some conversation, or he will be able to locate other conversation areas already created. The objective is to transform the General area in a meeting-point. From the general area, users will be able to join other specific topic areas, or create their own area for the topic they are interested in. Many other functionalities as connected users lists, area and users managing, etc., will also be present. Some control functions will only be available to teachers.

(Button "Teacher's mail") This button gives access to the Frequently Asked Questions (FAQ) document creator. Using some of the communications functions described later on, the students will be able to ask questions to the teacher, and this one will be able to answer them. Over time, some questions will be repeated over and over again. So, if the teacher thinks it is recommendable doing it, he will include both question and the corresponding answer into a database where other students will be able to consult it. Over time, the database becomes a very valuable document to help students for better understanding the unit contents, and the teacher finds most common questions already answered, thus saving time.

When clicking on this button, a new window appears. The students are confronted with a database consulting tool, while teachers have editing capabilities. The editing capabilities are usually restricted to a small set of teachers, or even only one of them. The FAQ documents are maintained this way just because we think that they are updated much more frequently than the unit pages.

(Button "News") It opens an space for asynchronous communications, where students and teachers are able to debate about any aspect of the unit being used. Note that asynchronous communication can take place without needing that communicating parts be on-line at the same time. This is an integrated "e-mail" and "news" feature, but controllable by the teacher. It communication also possible by using only the web and without having to have an e-mail standard account.

Clicking on this button a new window is opened. Students are able to read (and organise) their private mail, or read the messages sent to public addresses associated to any topic related to the contents of the unit. He is also able to send private e-mail to other students or teachers, or post public messages to the public addresses. All the messages are stored on the server. This scheme gives the functionality of both e-mail and news services, but with less complexity. Users will not need to have e-mail account nor e-mail and news clients, and will not need to configure anything. Teachers will be able to create public addresses and organise them, and will have total control over the whole tool.

This button makes it possible for students to ask questions privately to the teacher, without having to do it during the class, leading to better time saving and helping timid students to participate. Also, the use of the public addresses enables the creation of asynchronous debates. Teachers can promote the use of this functionality to incentive collaboration among students.

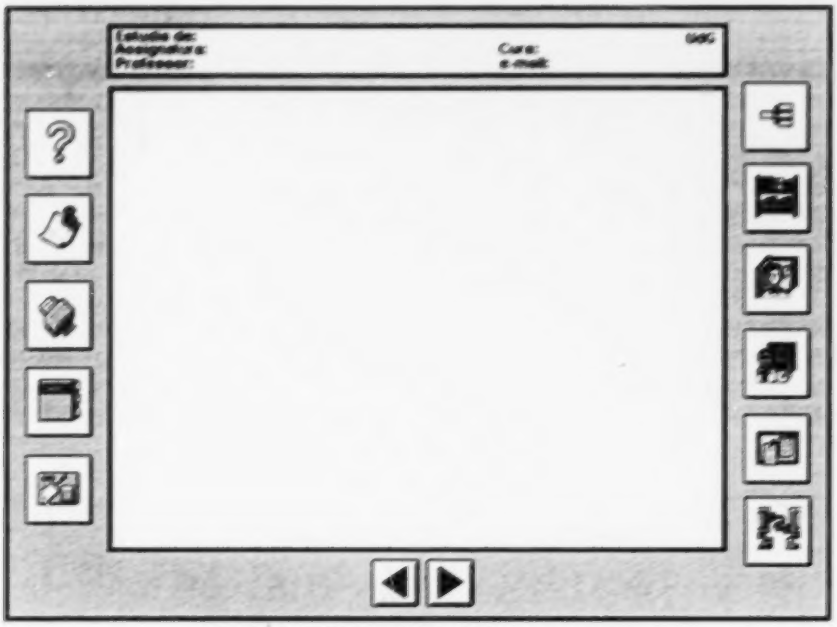

Figure 2 : The First Main Navigator Screen.

4. Conclusions and future work

This inter-disciplinary work is developed from both the first experimental unit and the users estimation, which will allow us to modify and improve the initial design. Moreover, this is a work in progress. The members of the project positively appreciate the inter-disciplinary environment to carry out the different components of the project : UCM, UNM and units contents. From initially different points of view about the matter, a more global vision that enhances the task of all members is achieved.

Note that this is a dynamic work. The design and implementation for future units also allow us to modify and evaluate the current proposal. This sort of work leads us to a true interactive platform that improves the communication between users and teachers, which is a major goal of the project. The current URL of the project is : http ://eia.udg.es/~usd.

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[W3C] W3C - The World Wide Web Consortium. http://www.w3.org

[WAO] Web Addressing Overview. http://www.w3.org/pub/WWW/Addressing

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